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APPARATUS FOR REMOTE RECORDING OF THE WORK OF PAPER-MAKING MACHINES

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An apparatus for remote indication of the operation of paper-making machines has been installed in the dispatcher's office of the Kama Combine. It keeps an automatic record of the work of four machines, the record being cut off when there is a break in the paper roll. In addition, electric bulbs show on which machines breaks have occurred. The apparatus consists of a recording logometer (instrument for measuring current ratio) and a light-signaling device.

As is well known, the logometer is usually employed in power engineering to register temperatures, the actuating element being a resistance thermometer. The resistance in the thermometer varies with the temperature, giving a corresponding curve on the diagram. If the thermometer is replaced by a fixed resistor which does not react with a change in temperature, a straight line will be obtained on the diagram instead of a curve. If the resistance circuit is broken under these conditions, the line traced on the continuously moving diagram will stop for a corresponding time interval, recommencing when the circuit is closed.

Automatic closing and opening of the circuit can be readily effected by fitting a contact-type device at the end of the machine activated by the tension of the paper strip. A break in the paper will open the circuit; resetting the paper on the roller will close the circuit. Automatic breaking of the circuit makes it simple to provide for the auxiliary light signaling.

In the modified version of the logometer, a relay which activates the recording part of the apparatus has been introduced into the circuit. This intermediate relay is necessitated by the fact that it is almost impossible to arrange for a reliable direct contact on a 4-volt supply.

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When the paper strip is set, the contact closes a 220-volt circuit and the current flowing through the relay coil creates a magnetic flux which attracts the armature and with it the relay contacts. The latter complete the 4-volt circuit and actuate the recording device of the logometer.

The drive of the kinematic part of the logometer is accomplished by means of a 12-volt circuit (through a step-down transformer). When there is a break in the paper strip, the contact device switches off the relay and recording ceases.

The whole mechanism of the logometer, except recording, is actuated by a Warren motor (12 volts at 60 rpm) which sets the recording chart in motion and causes the recording pen to drop at the proper time intervals. The recording pen moves along the length of the upper roller to the right and left due to the sequential connection of resistances by means of mercury switches actuated by fingers on the Warren motor.

To use the apparatus for recording the work of machines, there is no need to change its internal switching; all that is necessary is to fit suitable resistor coils on the back panel of the apparatus. These resistors are chosen so that the recording lines for the different machines are registered on the chart at equal distances. An intermediate relay RP-2A, the one most commonly used in electrical engineering, is connected to each resistor. Since this relay is designed for 110-volt direct current, the relay coils are rewound with the same wire but with fewer turns, so as to ensure reliable lifting of the armature and avoid overheating the coil.

The impulse contact on the machine was suggested and carried out by Comrade Kalmykov, acting engineer on the multimotor drive of the paper factory. It consists of a strip of sheet iron which slides along the paper strip; when the paper breaks the sheet falls and turns a roller, causing a switching plate to open the contacts. The whole arrangement is very compact. It is mounted on a textolite sheet 150 x 50 millimeters and covered with a stainless steel lid.

Efforts to use an impulse device from the roller drive of the machine did not give the desired results since the no-load current of the roller mechanism motor (14 amperes is almost the same as it is for normal operation (15 amperes. At the same time, existing relays with a low return coeffecient, adjusted to switch off at 14 amperes, can switch on only at a load of 18-20 amperes. Improved relays with a high return coefficient (electronic relays) are needed here.

The remote apparatus is so arranged that when the contact closes on any machine, the resistance circuit and recording device are switched on through the corresponding relay. When the contact is broken, the recording device is switched off and the signal lamp is switched on.

The graduated chart (with half-hour divisions 10 millimeters long) moves continuously so that a broken-line graph is obtained which gives the work of each machine separately and records the time and duration of each break. A one millimeter break on the graph corresponds to 3 minutes.

In the despatcher's office of the Kama Combine, an indicator board, in the form of a sheet aluminum box with partitions between the 25-watt lamps, is secured to the wall. The logometer is mounted on a base and can be moved and turned around when it is necessary to change connections on the panel. The logometer and its base stand on a cabinet, 80 x 80 x 40 centimeters, which contains a relay and switching panel, a 220/12-volt 100-watt transformer and a copper-oxide rectifier. The indicator board can function independently when necessary.

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The apparatus gives a clear presentation of the work of the machines. By measuring the gaps in the graphs on the diagram it is possible to establish accurately the duration of no-load runs and the time of effective work. In the absence of meter counters, paper production for any time interval can be determined with sufficient accuracy on the basis of the diagram from the speed of the machines and the weight of the paper. Drawbacks of the apparatus result from imperfections in the impulse contact and the throw of the indicating pointer.

The instrument described above requires skilled adjustment and maintenance as its internal switching is too complex for the ordinary electrician. Accordingly, a second model of the recording apparatus, in which the electrical circuit was simplified as much as possible, was developed in the thermal laboratory of the combine. In this new apparatus, the whole internal electrical circuit of the logometer was replaced by electromagnetic coils with suitably modified holders for the recording pens.

The electromagnetic coil unit is installed in the logometer box on a shelf made of 45 x 45 millimeter angle bars. The pen holder pivots about the coil while spring tension is applied to the other end, thereby holding the pen off the chart until the coil is activated. The tape feeding mechanism remains as before. The roll or perforated paper is unwound by a toothed drum driven by the Warren motor in the logometer. The electromagnets used are telephone relay coils designed to operate on 24 volts. As it turned out, they also work well at 12 volts. Thus, the apparatus requires only a 12-volt direct current supply for the coils, indicator lamps, and Warren motor.

The apparatus is being used on six machines and has proved reliable in operation and simple to adjust and maintain. It should be mentioned, however, that the impulse contact which is subject to continuous vibrations, due to the motion of the paper strip, requires further improvement.

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